

# NASA Facts

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(202) 358-1600



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## Transcript

### Columbia Accident Investigation Board Press Conference August 26, 2003

GEHMAN: Good morning. We will follow the same process that we follow at all of our press conferences. I have a short opening statement. I will ask my colleagues to each make a statement about their part of the investigation. I'll summarize. And then we'll open the floor to questions.

I'd like to start off by saying that we are here nearly seven months since the tragic loss of Columbia, and our efforts, the intent of our report and all of the many hours that we put into this investigation were done to reflect favorably and to reflect with honor on the efforts of the crew--Rick Husband, Willie McCool, Mike Anderson, Dave Brown, K.C. Chawla, Laurel Clark and Ilan Ramon.

The lives of these people are very precious to us, and the board considered that a very serious matter, that these brave people thought that what they were doing was important, that it was significant, that it was part of human space exploration, that the things that were going to be learned from this mission were worth the risk that they were taking.

GEHMAN: And if this board has any impact whatsoever, we felt that the loss of their lives had better make a difference or both them and us have wasted our time.

The board also would like to express it's, and I as the chairman would like to express our most profound thanks to a lot of people. I'd like to express my profound thanks to my 12 fellow board members, who essentially gave up their lives for six and a half months to put an awful lot of effort into this report.

We essentially worked seven days a week as you're aware, but most of these people either one, they put their previously life aside and devoted 100 percent to this investigation, or two, some of them began leading two lives and keeping two

jobs. And they did the investigation in the daytime and they did their other duties at night.

We had a staff of about 120 people on the investigation team, to them I owe a lot. They worked very, very tirelessly. They did brilliant work. They probably will never get their names in the newspapers or on television, but they did a wonderful job and we as a board are indebted to them.

To the hundreds and hundreds of **NASA** employees who assisted us with this, we are indebted to them. They also made a great contribution.

And lastly, as I have mentioned in almost every press conference that I have taken part in, the 25,000 to 30,000 private individuals who helped us, mostly in the area of the debris collection but in lots of other ways too, we owe a great debt to all of them.

As you may be aware, for example, we had over 3,000 unsolicited public inputs either in the sense of letters or e-mails to our Web site. We had all those debris collectors who marched shoulder to shoulder through the state of Texas picking up that debris which turned out to be so significant. We had pictures of people who contributed photography and videography, all of which contributed to this accident investigation. So we owe a lot of people thanks, and we are the first to acknowledge we could not have done this by ourselves.

GEHMAN: Let me say at the outset that this board--and I think I can speak pretty confidently for the 13 members, or the other 12 members of the board--this board comes away from this experience convinced that **NASA** is an outstanding organization.

It's full of wonderful people who are trying very, very hard to do very unique and very special things; things that are not done any other place in the world and, for the most part, have never been done by mankind before. And we would like to make sure that the American people realize that they have an institution of which they should be very, very proud in the form of **NASA**.

If this board had set out to spend seven months listing all the good things that **NASA** does, the report would be thicker than this. Unfortunately, that's not what our task was. And the nature of these investigations, it causes all of the good work and all of the wonderful things that are accomplished to get lost. And I think it's worth that we take a second and say that we are impressed by the work force. We are impressed by the people. And we are impressed by what **NASA** has accomplished.

Nevertheless, there are some things they can do better. It is our intent, by the publishing of this report, that those things that they need to do better get documented and that we provide the impetus for those changes.

Next, I think I speak confidently for the board in which we can state a conclusion that the space shuttle is not inherently unsafe. And that this board was under no pressure to say anything to the contrary.

The fact that the International Space Station is up there, the fact that the United States has obligations to finish the International Space Station, and that lots of other factors like the sunk costs that are already in the shuttle, et cetera, I can speak confidently for myself, and I think I can speak confidently for the 12 members that this board was under no pressure to say that the shuttle could continue to be operated. If we thought the shuttle was unsafe we would have said so.

GEHMAN: Now, that's not to say there aren't a lot of things they need to improve the safety of the shuttle. But if we thought that this shuttle was just inherently unsafe, we would have said so.

However, that does not mean that there are lots of things they should do to operate this thing more safely, and that's essentially the context of our report.

There are some things that need to be done immediately. We have listed those, and we call those return-to-flight items. We'll be glad to talk about them as the time goes on. And then there's a second group of recommendations, which we call, continuing to fly. The board feels that there will be so much vigilance and so much zeal and so much attention to detail for the next half dozen flights that anything we say probably is an understatement compared to the energy and the diligence that will be--that NASA will naturally put into making the first couple flights safe.

The board, however, is concerned that over a period of a year or two, the natural tendency of all bureaucracies, not just **NASA**, to morph and migrate away from that diligent attitude is a great concern to the board because the history of **NASA** indicates that they've done it before.

Therefore, we have a group of recommendations that are designed to prevent that, that backsliding or atrophy of energy and zeal. And those are the second group of recommendations that we call continuing to fly. And those are more fundamental and harder to do, but they are just as important--perhaps more important--than the return-to-fly recommendations.

And we are careful not to create any hierarchy of recommendations. We don't have a set of recommendations which are more important than others and a second group that's less important, and a third group which is third important. We were careful not to make that distinction.

You will not find in this report terms like ``contributing factors" or ``underlying causes." We don't believe in those terms. We believe that these other

organizations--these other organizational kinds of recommendations are just as important as the return-to-fly ones.

And then there's a third group of findings, observations and recommendations that consists of all the things that we observed or noted that we were not particularly pleased with, but didn't have anything directly to do with this accident. But they might contribute to a future accident and we strongly recommend that **NASA** pay attention to them, too.

We, once again, suggest to our readers of this report that you not mentally categorize these three categories of findings and recommendations in any kind of hierarchal order.

GEHMAN: To us, the golden nugget which may prevent the next accident could be in that third group. Just because it didn't have anything to do with this accident, you should not prioritize them in any other way. We feel very strongly about that.

I will stop talking here because I get the last word, and I will ask my colleagues here to say in just a few minutes to talk about their contribution to the report and the section that they're willing to--that they're ready to talk about.

I would like to have the boards put up, if we could have the board putter upper put up the boards over there. That'll happen while we're speaking. And I will then come back, say the last few words, which will be some words about the future, and then we'll open it up to questions.

So I'll turn to my colleague here, Dr. John Logsdon, in group four.

Go ahead, John.

LOGSDON: Thank you, Admiral.

The STS-107 accident happened at a particular time in history, but the history part of it the board decided very quickly after it started its investigation was important. We looked at this as an accident rooted in the history of **NASA** and the history of the space shuttle program.

We've given equal weight to the organizational causes that come out of the history of **NASA** and the program, and you've seen in the report, you'll see in these storyboards the statement of the organizational cause. So I'm not going to repeat that.

But as I was added to the board about a month after it started, I was given the mandate to try to trace that history and we did that, the history of the original decisions that shaped the shuttle program, which are in chapter one of the report,

and then the history from Challenger to Columbia, which are in chapter five of the report.

I think we can summarize what's there in terms of three main points. One was the budget pressures and work force pressures. In order to fund other parts of the **NASA** program, the shuttle program was squeezed during the '90s. Its budget was cut by 40 percent. Its work force was cut by 40 percent. That left too little margin for robust operation of the system in our judgment.

LOGSDON: It was operating too close to too many margins. There was a mischaracterization, maybe even a misunderstanding of what the shuttle was as a mature and reliable system, about as safe as today's technology will provide, to quote out of a 1995 report.

Based on believing that the shuttle was a mature system, **NASA** turned a lot of its operations over to a single contractor. But importantly, turned a lot of **NASA** responsibilities in safety and mission assurance over to that contractor and backed off, did insight rather than oversight of the program. And we believe that was a mistake and that there needs to be stronger technical oversight by civil servants, by government employees of the program.

**NASA** acted as if you could count on the shuttle to carry out operational missions from '98 on, mainly space station assembly and supply, while not also collecting the engineering information that is associated with its developmental status. We believe that was a mistake.

There's a great deal of uncertainty about how long the nation would use this shuttle. And sometimes it was being treated as a going out of business program, sometimes it was being treated as central to the long-term future. Just in the '90s, the replacement date went from 2006 to 2012 to now 2015, 2020, maybe beyond. That made it very difficult to decide how much to invest in the system, invest in the ground infrastructure which was deteriorating.

So the whole system was operating in ways that were characterized by uncertainty, by stress, by tension. It's hardly an environment for effective safe operation as a program, the board concluded.

Underpinning all of this was what we characterized as **NASA's** human space flight culture--that word has been in the news a lot--we provide a definition of culture as the basic values, norms, beliefs and practices that characterize the functioning of a particular institution. We go into some detail in discussing the particular **NASA** human space flight culture, and come to the conclusion that it must be modified for success in the future.

LOGSDON: Thank you.

GEHMAN: Thank you very much.

Mr. Hubbard?

HUBBARD: Thank you.

In four simple words: The foam did it. I refer you to the physical cause statement over here. I'm not going to read it. But after months of inquiry, after a lot of analysis, after a series of tests, we concluded that the falling foam impacting the leading-edge of the wing was the cause of the breach that ultimately led to the destruction of the orbiter and the loss of the crew.

I'll point out one thing about the statement, which is that we do not include the words "probably, likely, most probable." All of this exhaustive work that we've done, all the discussion and the testing have led us to the simple statement that the foam was the result--the foam resulted in the breach that led to the loss of the orbiter.

My personal involvement has been very deeply engaged with the impact testing. I feel that testing accomplished three things. First of all, it provided the experimental evidence that corroborated the lines of analysis--these five lines of analysis that Sheila Widnall will describe in a few minutes. It provided an explanation point to the directions that the analytical work was pointing to.

Second thing is that, of course, it added to the body of knowledge about this reinforced carbon material that turns out to be a lot tougher than anybody thought it was, a lot tougher than the original specification, but unfortunately not tough enough to withstand an impact of this piece of foam at 500 miles an hour.

And finally, I think the tests accomplished a third psychological or sociological accomplishment, which is to remove any lingering doubt that, indeed, this light material could break open the leading-edge and could lead to the loss of the orbiter.

I think all of this work by our group in establishing the physical cause brings us to the point now, where coupled with the organizational cause, we're able to make a series of recommendations that you'll hear about later, that includes my statement.

GEHMAN: Thank you very much.

Dr. Widnall?

WIDNALL: OK. Well, many of you have been with us since the beginning, and you followed in great detail the analysis and the work that has been going on. So

as you know, the board conducted an in-depth investigation of the various events that occurred, primarily focusing on those events that occurred during re-entry.

At the very beginning we had data from on board the shuttle that was telemetered (ph) to the ground. And this time line gave very important clues as to what had happened. You also know that in the midst of our investigation, what might be called the flight data recorder--we call it the OEX recorder--was found which, again, gave us a wealth of data from on-board sensors that provided information about temperatures and pressures and locations of various things that were going on.

We did have these five parallel lines of work. We had extensive wind tunnel tests and extensive analysis of the aerodynamics of this vehicle, including its aerodynamic response, its flight controllability. There were detailed thermal analysis to look at the affects of heat in various parts of the structure.

WIDNALL: And then, basically, burning through or melting through or breaching of various parts of the structure. But we had video and photo analysis, much of it taken by the public, which indicated the various events, flashes, debris pieces that occurred during the flight and these were all pieced together to give a fairly accurate indication of what had happened.

The debris was absolutely invaluable. The debris told us a lot about the direction of the flow at various critical areas, about temperatures. Chemical analysis of the debris told us about deposits of various kinds of metals--whose melting point we know--that were deposited on the various pieces of debris that were recovered.

And in all of that, we were able to derive a very self-consistent picture that, as Scott mentioned, we really have a very high degree of confidence in. I think one of the important things that was demonstrated from the on-board data was that the breach in the leading edge was pre-existing. In other words, we had thermodynamic events that occurred on re-entry that occurred at a time when the aerodynamic forces were insignificant. So it leads strong belief to the fact that the breach in the wing was there before re-entry occurred.

We were able, through these analysis, to document and time line the various flight events that occurred. Ultimately, the vehicle, because of structural damage, essentially became uncontrollable. Up to that point, the flight control system had managed to keep the vehicle flying, the planned trajectory. But finally, it could no longer keep the vehicle flying.

And I think the other thing to mention is that, at that point, the vehicle was so damaged that there would not have been a possibility of successfully, you know,

continuing the re-entry of this vehicle, even if the vehicle had progressed into a region where the heating was reduced.

So this was, obviously, a catastrophic event that determined that the vehicle would be lost. That's basically...

GEHMAN: Thank you very much.

Mr. Wallace?

WALLACE: I'm going to talk a little bit about--sort of the part of the story that fits between the physical and organizational cost statements. Chapter 6 of the report is entitled ``Decision Making at **NASA**," and there are sort of four stories told in there. A couple of them are fairly familiar.

The foam story, you've kind of lived through that with us. Foam was coming off the orbiter from the very first mission. **NASA** requirements dictated that this not happen, that nothing ever striking the orbiter could possibly damage it, but it happened on every flight.

It actually happened that there was an average of 30 or so dings in the thermal protection tiles on all flights. Seven occasions of bipod ramps falling and, of course, a severe bipod ramp failure then, just two flights before STS-107. I know that's a familiar story. And the question we all asked is--the machine was talking, but why was nobody hearing, how were the signals missed.

The imaging story, the request for imaging on orbit, the related decision making, all the e-mails that you've all seen and printed--that story is laid out in great detail in Chapter 6 as well, also with information gained from other sources, interviews and various records.

WALLACE: The third story in there to actually come second is the schedule pressure story which has not been quite as extensively discussed during the course of the investigation. And I would say that the schedule pressure story is laid out in great detail in the report. I think it's fair to say that opinions can easily differ, they have among us on the importance of this issue and it's not easily quantifiable. There are a lot of subtleties in the schedule pressure. We're not talking about fists banging on tables, we've got to launch on this date, but rather more subtle pressures and influences.

And I would encourage you all to read that part of the report carefully and I think you'll conclude that it's thorough and probably that it's fair. And like the entire report, we hope that this entire story is thorough, that it's fair, and that it really helps the human space flight program in the long term.



The fourth story in chapter six is about the repair and rescue possibilities. We asked **NASA** to do a study on this which we think they did very, very forthrightly and thoroughly. I think there are two reasons to look at that: one is to simply know if it was possible or what were the probabilities of being able to affect the repair or rescue mission; and the other is to analyze how it affected the thinking on the mission, whether that possibility if it had been better understood might have altered some of the decision making during the mission.

From chapter six we go into chapter seven and eight, which discusses in context of organizational theory more of the relationship of this decision making and studied in the context of other high reliability organizations. Other organizations which do very high-risk work and quite successfully--naval reactors, substate programs--different programs are analyzed in there and the entire accident and also the Challenger accident are really evaluated in a thorough historical context in chapter eight.

I think it's important, although it's a daunting task, to read this report from one end to the other and then you come away with the entire story.

Thank you.

GEHMAN: OK.

General Barry?

BARRY: Thank you, Admiral.

Now, my comments will be on safety culture.

Now, as the admiral has said, we've met some fantastic and outstanding **NASA** employees all the way through. You talk about safety, industrial safety is world renowned. However, it's our view that the broken safety culture resides in the human space flight.

Now, I refer to our organizational chart where we talk about the cause, but clearly there is still evidence of a silent, safety program with echoes of Challenger. And here's the Challenger report.

**NASA** had conflicting goals of cost, schedule and safety, and unfortunately safety lost out in a lot of areas to the mandates of operational requirements. So what we went through in our analysis is trying to figure out how we can fix the culture, and it's not an easy task. In order to do that, you have to do some organizational changes and clearly we have made some of those recommendations in this report.

But the second part of that recipe is leadership, and that is where **NASA** has to do its role. We can only provide recommendations on some of the changes, but the leadership is clearly key to that.

The other thing I want to mention is that we had some concerns about safety regarding independence, and you'll see that as one of the key recommendations when you get to the organizational part. There was and has been evident a lack of integrated safety functions, but more importantly, a lack of integration within the space shuttle program itself.

We have evidence and interviews and our research has shown that the integration office was not truly an integration office.

BARRY: And that compounded the safety culture problems--I'm trying to get one story for the whole program.

There also is barriers to communication and some of them that are cited are lack of shuttle--ineffective information systems, databases. And finally going back to the silent safety program issue, we found evidence of silent safety in not only the program, the flight readiness review, the debris assessment team and the mission management team.

So, ladies and gentlemen, it is still there.

That concludes my remarks,sir.

GEHMAN: Thank you very much.

Admiral Turcotte?

TURCOTTE: Morning.

I'd like to talk a little bit today to you about my experience, primarily my focus in the investigation and my good friend, Brigadier General Duane Deal, who's not here today, who's on his way from Houston to this location. The two of us spent the majority of our time getting very close to the people that maintained the orbiter and also built the various other pieces (inaudible), the external tank and the solid rocket booster.

That was primarily our focus. And in chapter 10 I'm going to talk to you a little bit today about some other significant observations that we found in the course of the investigation. We naturally went through the maintenance records of Columbia 100 percent. We went through all of the existing maintenance records all the way back to day one. We went back through every maintenance period that it had, and then every single major gripe that we could focus in on that had anything to do with TPS or the thermal protection system.

Then we looked at a random sampling of all of the other orbiters and looked at how they did maintenance, whether it was a **NASA** employee, or a contractor employee, it didn't matter. We went through the depth and breadth of this. So I'd like to throw out, in our time on the shop floor those are good people. The people that are down there working, they're working their hearts out. They've got the right idea, the right mind set. They're trying to do the best they can.

These observations I'm going to show out today are indicative of something that you could walk into a lot of organizations, but in particular we found some things that are different from the aircraft industry standard or the military industry standard, and those are what I would like to just throw out.

First off is the QA program. QA program, they went through a series of down sizing, took their inspection points and made them a number of 85. They left them pretty stagnant. Well, as you know, this is an aging orbiter. If you look inside that airplane, airplanes that I flew 25 some odd years ago, it's very similar to that. The problems that we had with corrosion are ongoing.

TURCOTTE: The problems as this air frame changed, also the inspection points will change, and that's an industry standard. As an aircraft ages, the maintenance changes, the inspection points changes. We found that to be lacking in the QA program.

We found out in the corrosion program, a lot of hard things to do there. There is, for example, the capsule. There are some points that we'll, short of taking the orbiter apart, never be able to get to look at. So **NASA** has to figure out some ways to get in there and look at those and find out the true age of the orbiter.

We looked at a lot of the test equipment that was used in the industry today. A lot of the equipment that is used on that program is 22 years old. It's frozen in time. It's just as it was when that thing was built. There is a lot of good test equipment out there that is in use in the industry and we've made several recommendations to incorporate that.

There are some other anomalies that we saw looking at--you've heard of the famous hold-down cable, or hold-down bolt cable problem. Just the way that that problem was treated, and if you apply the technical wiring and the engineering, the way that problem was treated does not meet industry standards.

Classification of FOD (ph)--my good friend General Deal dealt a lot with this. If you look at the way an aircraft on the flight line versus the way an aircraft in a factory are treated, they are two different entities. With the space shuttle, it's pretty hard to tell the difference because you're looking at one hangar, you're doing a major maintenance where you have to open this thing up to the world and do some very major repairs. Then you look right next to it, you have somebody working in an operational mode where the rules are different.

So we're making some recommendation that de-standardized the classification of FOD (ph) across the board for both of those.

Generally, all in all, I want to refer back to my first statement and what I said, the people on the shop floors putting this orbiter together and maintaining it have the best heart and souls. They are absolutely wonderful people, and it's been a pleasure working with them.

And I just want to leave that final thought to you, that on the shop floor they are looking forward to getting this thing and as the cry from one of the supervisors when I left, he said, ``Sir, we hope you find it, you fix it and you fly it."

And with that I would like to conclude my remarks.

GEHMAN: Thank you very much, colleagues.

I'll wrap up here and we'll get to the questions.

As we indicated when we started this investigation six and a half months ago, this board has five constituencies. And at ten o'clock this morning, Eastern Daylight Time, our report was delivered personally to all five constituencies simultaneously. Three board members who are not here are in Houston and they personally delivered the same report that you're receiving here along with copies of the report to our two constituencies in Houston, that is the astronauts, the astronaut corps and the families of the astronauts who lost their lives in this accident.

Meanwhile, here in Washington at ten o'clock this morning, the report was delivered to representatives from the White House, the Congress and to the administrator of **NASA**.

GEHMAN: As a matter of fact, three of the board members, the reason they're not here is because they're down in Houston doing that, and they will be joining us. They're flying back this afternoon.

So I'll just close by saying that the board is quite convinced that most accident investigations do not go as far as we did, in that most accident investigations find the widget that broke. They find the person in the cause chain closest to the widget that broke, require that the widget be redesigned or replaced, and the person fired or retrained, and then call it a day. And they do not go far enough to find out why would this happen.

And the failure of that is that you really haven't fixed the problem which caused the problem. You really are setting yourself up for a repeat if you have other organizational or systemic problems. And because it took the board a considerable amount of time to convince itself that the foam did it, we had ample

time to look into these other causal categories. And we are quite convinced that these organizational matters are just as important as the foam.

Our recommendations, which I will now ask that the board--that was very good, you were there ahead of me--our recommendations could be roughly organized along the following kind of logical lines.

What we said is what we would like to do, in the sense of our recommendations, is we would like to break up or loosen the close coupling between debris hitting the orbiter and losing the lives of astronauts. In order to do that you have to take several steps, not one step, but several steps.

The first step you have to take is you have to understand and reduce the amount of debris that the stack sheds, whether it be foam or ice or whatever.

The second step is you have to toughen the orbiter so that it can, indeed, fly through a cloud of debris without doing itself some damage.

The third step is you have to provide a system by which the orbiter can be inspected and repaired in case it did get a little ding or something like that and so that it does not become a life-threatening event.

And the fourth step is you have to do something to enhance the crew's survivability.

Now, we addressed the first three completely in our report. The fourth step, enhancing the crew's survivability, we've decided to arbitrarily leave that up to **NASA**, and they have done some work in that area.

We organized our recommendations into three categories. As I indicated before, short-term fixes, which you might call return to flight; mid-term, by mid-term we mean something like two to 10 or two to 15 years or what I call continuing to fly recommendations.

And then, a long-term, and there the board has written editorial comments about what the nation should do about human space flight, about replacing the shuttle as our human-carrying vehicle. And we have editorialized about what we should do long-term.

Therefore, the intent of this report is that this report, in our words here, should now be the basis for what we hope will be a very vigorous public policy debate about what do we do now. How soon do we replace the shuttle? What is the United States' vision for human space flight? And once you answer the question, ``What is our vision?"; you have to then answer the next question, ``Are you willing to resource that vision?"; because this stuff is not cheap.

GEHMAN: And what should be the balance between human space travel and robotic space travel? And a number of other public policy issues which are not the purview of this board to answer. These questions are the purview of the government of the United States and its agencies.

So we aren't ducking anything here, what we have done is we have established all the facts, we have characterized **NASA** and the space flight program in a way that's not been done in this depth before. We have characterized the risk. We have characterized their strengths and their weaknesses.

And now we turn this report over to the people in the United States who establish public policy, who is not us.

So with that I would then conclude and I will turn it over to Ms. Brown, who will orchestrate some questions.

MODERATOR: I'd like to take questions for about half an hour. The way I'd like to do that is to try to do it geographically just so our guys with the microphones can maximize their maneuverability. So if we can take questions to the right over here first.

QUESTION: On the organizational managerial problems, I was struck in reference to the STS 113, Flight Readiness Review, a reference to the slight of hand in calculating the foam loss, making it seem not as bad as it was. And also, during the Columbia flight, Linda Hamm's (ph) comments that the rationale was lousy to keep flying and it still is.

This sounds more than overconfident, it almost sounds negligent, and could you address that? And why wouldn't you want these kinds of problems fixed before we turn to flight?

GEHMAN: The role of establishing judgments on personal performance is not one that we set out to do. We have said since the first week that we'll put the facts in the report and we'll let the proper authorities determine whether or not that is a matter of performance or not. To us, statements like that are data and we use them to determine how the system operates, not how the individuals operate.

Steve Wallace, you want to follow up on that?

WALLACE: Well, and I think they are both certainly being corrected. The slight of hand refers to a calculation about falling bipod ramps which sort of use the fact that there were two bipod ramps. One that had never ever fallen off, over there, the right hand one by the locks line which--probably aerodynamic reasons or whatever.

So we thought that the probability calculation didn't--if it were accounting, I'd say it wasn't done according to generally accepted accounting principles, and an engineer would say something roughly equivalent to that.

And yes, the lousy then, lousy now, and the report of course includes the view graph which details the decision making on launching 113. I think that's all in the context of the greater story of sort of the normalization of foam. And then 107 is launched subsequently and the issue is no longer even on the table. So those are--as the admiral said, that's data which forms a part of the larger story.

GEHMAN: And, John--very quickly, John?

LOGSDON: Yes, sir.

Just to answer the question about the recommendation, if you look down on the bottom organization, one is RTF. And that is to develop a plan to get a technical, independent review capability, to develop an independent safety and to develop a better integration. So that is a return to flight requirement, that we're asking for organization.

GEHMAN: OK, thank you.

MODERATOR: OK, thanks.

Thank you.

QUESTION: I think this is probably for General Barry. On the technical engineering authority, could you explain a little bit more what you would envision accomplishing by stripping **NASA** management from operational or separating the operational decision making about just shuttle processing from, like, the technical requirements of the shuttle and how you would see that working in a real-time scenario?

BARRY: Well, the recommendation you're referring to--as Steve has just pointed out to me--establish an independent technical engineering authority that is responsible for technical requirements and all waivers to them and will build a disciplined systematic approach. What that really means is we're trying to separate the requirements from the program.

If the program is competing cost and schedule and they still own the requirements and the waiver authority, you will sometimes find that you will compromise the waiver and the safety precaution schedule. So what we've found by looking at best business practices, particularly sub-safe in the Navy and the aerospace organization is that by separating this out, you put a check and balance in the system that clearly allows the system to work in a more fair basis. You don't put safety and waiver and technical requirements at risk with the same

organization that is compelled to work schedule and schedule pressures and the ability to launch operationally.

MODERATOR: OK, in the blue, Richard?

QUESTION: You have focused a great deal on culture and the need for **NASA** to change culture. But how can an organization like that change culture, particularly when you look back at Challenger, you see a lot of the things that were said pre-Challenger exists today. Is it possible to change culture?

GEHMAN: Well, we--I'm going to repeat what General Barry said in his introductory remarks. We thought a lot about this. We thought long and hard about this. We discussed it for hours and hours. And we have come to the conclusion that there are two steps into changing the culture--part of the culture that needs to be changed.

Now, first of all, keep in mind there's good culture and there's bad culture. You know, you can have a culture of safety and you can have a culture of openness and you can have a culture of honesty and all that good stuff. So you know, culture is not a bad word.

As John Logsdon indicated when he defined culture, culture is the way that the organization habitually acts absent rules. In other words, this is the way the people kind of intuitively act regardless of what the rules say. We think that there are two steps to changing--to weeding out the bad parts of the culture and changing the culture that needs to be changed.

One is you can take some organizational steps that help a little bit, but you--we believe that you can change a bad organization by reorganizing it, but you cannot change bad culture by reorganization. It takes both reorganization and leadership.

The leadership, not just the administrator, all levels of leadership are going to have to actively drive the bad cultural traits out of the organization. And it's something they're going to have to buy into personally, they are going to have to accept it in their gut, and in their daily reactions, they're going to have to look for these traits that we have carefully enumerated in our report like stifling communications and stomping on engineers and things like that. And they are going to have to drive it out.

And it is not simple, and that is why we did not make it a return to flight issue, because we know it can't be done between now and the next flight. It will take a long time.

QUESTION: Admiral Gehman, I believe it's Dr. Logsdon who has called **NASA** culture a fortress mentality. Am I right?



GEHMAN: No.

QUESTION: Somebody has.

Anyway, given the loss of the Cold War impetus that you cite in the report, and given that the public and the Congress seem to have indicated a desire for a space flight program but not a great willingness to pay more for it, what are your comments on continuing to fly under those very same circumstances?

GEHMAN: You are edging up toward the answer to the public policy debate that we are challenging the government of the United States to have.

I think that in the sections that John referred to, chapters one and chapter five of the report, in which we establish a historical context of how we got to where we are, it paints the picture that there's two sides to this issue.

That is, one side is that **NASA** over the years has over-marketed, over-promised and underestimated what these things cost, and therefore we've gotten ourselves in a position to where we have programs now that we own that are extraordinarily expensive and they never, ever have achieved either the goals or the cost goals that they set for themselves.

But that doesn't mean they can't be done. I mean, that doesn't mean that space travel can't be done relatively safely.

So it seems to me that the answer to your question is perhaps some renewed honesty on both sides of the equation here in which **NASA** doesn't over-market programs in an effort to get program and that also the branches of our government don't require unrealistic goals that can't be achieved. And I believe that's laid out in our report.

John, you want to say something about that?

LOGSDON: Well, I think the only thing I'd add to that is that the people that provide the resources for human space flight--the White House, the OMB, the congressional authorization and appropriations committees--all certainly believe that they're providing adequate resources. Nobody is trying to squeeze the program below an adequate level.

On the other hand, human space flight has had to compete within **NASA**. The shuttle's had to compete with the cost of the station. Human space flight has had to compete with robotic space flight. **NASA's** activities have had to compete with other science and technology areas.

And the country has been kind of ambivalent about how serious it is about its long-term space program and has done it, I think in our judgment, at a budget level not adequate to have a robust program.

And you can't draw a causal line that says, ``Budget constraints caused accident." We don't go there. We say it created an environment in which some things that could cause accidents could emerge. So it's a multi-layer kind of causality that we're talking about.

GEHMAN: And in our report we try and establish in chapter nine, in kind of the editorial section of our report, we suggest a way out of this dilemma. And without prescribing what the next program should look like or what the next vehicle should look like, we suggest that what really needs to happen is that we need to decide as a nation what it is we want to do.

We shouldn't start off by trying to design the next vehicle. That's a trap, and it's a trap we've fallen into three or four times in the last 15 years. We should decide what it is we want to do.

And the board suggests that what it is we want to do is to get humans in and out of low earth orbit routinely and safely.

GEHMAN: That's what it is we want to do. Not add a whole lot of bells and whistles to this thing, like single-staged orbit and build it out of the famous unobtainium (ph) material that floats around here and get on then with a program to support an agreed concept of operations or whatever it is we want to do.

In other words, reign in our appetite, properly fund the program and develop a program that is executable within what the nation wants to pay for it. It's in our report how to do this. Now, we didn't design the vehicle for the nation, but we told them how to get out of this dilemma.

MODERATOR: OK, in the third row right behind Kathy?

QUESTION: Admiral Gehman, we have here details--finding on details, a recommendation. If you have to tell the American people briefly what caused that accident that day, what are you willing to say in a few words?

GEHMAN: In a few words, I would say there were two causes to the accident. The first cause was the foam that came off and hit the reinforced carboned (ph) carbon. The second was the loss within **NASA** of its system of checks and balances.

QUESTION: This week, my daughter Amy is at the **NASA** Space Camp in Huntsville, Alabama. Would anyone have any special words to help a child and student like her to help her understand what happened?

GEHMAN: Dr. Widnall, would you like to take that on?

(LAUGHTER)

GEHMAN: Well, the reason I pick on Dr. Widnall is because she deals with students and she has actually lectured us on the floor on what the students expect.

And so, Dr. Widnall, I'll ask you to answer that.

WIDNALL: Well, I think it is the case that space and the idea of space is really a great motivator for young people. I don't think there's any question about that. And I think--I certainly view one of my jobs as an educator is to take that basic motivation and turn it into what I would view as responsible engineering, recognizing that the passion that we have for space flight needs to be realized in a system that can responsibly execute these programs. So--and that may be a big mouthful for your daughter, but that's my view on the whole issue.

LOGSDON: Could I add a...

GEHMAN: Sure, absolutely. Dr. Logsdon, another educator.

LOGSDON: If you look at the backgrounds of the board members, the 13 of us, nine of the 13 had very little or no involvement with **NASA** or with space flight before they became members of the board. All 13 in the report are unanimous in the importance of continuing human space flight.

None of us have come to the conclusion that it is not worth the risk and not worth the money, and I think that message is one of the positive messages that ought to come out of this report.

MODERATOR: OK.

GEHMAN: Thank you very much.

QUESTION: I have a question about two of your return-to-flight recommendations that involve the thermal protection system. One of them calls on **NASA** to eliminate all external foam debris and the second asks **NASA** to initiate a program to increase the ability of the orbiter to sustain debris hits.

As I read this carefully, both of those look like they allow a fair amount of wiggle room for the agency because it asks only that you initiate an aggressive program. Does that mean that before the orbiters resume flights that those improvements should be in place or only that **NASA** begin an action program to do so?

GEHMAN: The recommendations--our study, after months and months of this, leads us to believe that it's unreasonable to require as a return-to-flight item that they eliminate all debris shedding from the launch stack. There will always be some ice.

And the application of the insulating foam on the external tank is really a very difficult process to do. And so that recommendation aims at the problem that we found that they are not aggressively trying to understand the foam, that they aren't--we found--you remember Doug Arshwarb's (ph) famous experiment in his kitchen, where he discovered some things that--how the foam acts that were contrary to what was published in some **NASA** technical manuals and, et cetera, et cetera.

GEHMAN: So that is aimed at a continuing nonstop program at understanding how the foam acts with an intent of eliminating debris shedding eventually. But we didn't think that saying that you've got to stop all shedding before you can launch again is reasonable, because that's not how the machine operates. So it is initiate a program with the intent of understanding what causes foam to come off with the ultimate goal of eliminating it.

QUESTION: Does that apply also to (OFF-MIKE)

GEHMAN: Yes.

QUESTION: (OFF-MIKE)

GEHMAN: That's correct.

But both of those get at our problem--one of our problems with **NASA** engineers is that, because the money has all dried up in research development, they aren't even trying to find out what the materials do. And so that's what that recommendation's (inaudible)

WALLACE: May I add something?

GEHMAN: OK. Very quickly, Steve.

WALLACE: I think you have to take it all into context. I mean there's an extensive set of recommendations on-orbit repair. One point, that is a flat return to flight, not an initial return to flight, on-orbit repair. And you know, so, of course, the board is attempting working to eliminate the source of the debris, improve the ability to tolerate a strike should it happen. And of course the most critical thing is perhaps the falling bipod, which **NASA**--you will never see another bipod ramp on this vehicle (inaudible) bipod ramp.

You know, there's a lot of work in progress that we're well aware of and have been following in addition to what's simply on those recommendations.

QUESTION: I guess for General Barry and anyone else who cares to weigh in. I'm wondering if you had an emotional reaction to this report? It's a pretty powerful document. That what you found as you plowed through this institution make you angry or sad?

BARRY: That's a tough question. I mean, after seven and a half months of looking at this thing you can't help but get emotionally connected to not only the people, but the organization.

And as Steve Turcotte mentioned, you know, you really do find an agency that is just full of outstanding, superior, well-motivated individuals. But anytime you deal with an agency in crisis, you really find out what the guts of the organization is made up of.

And one of the things that we want to make sure that we leave here, and as the admiral said, is the legacy in honoring the crew that lost their lives. So there's not one day that didn't go by that we didn't pass the photograph of the crew right by the entry to any of our organizations.

And if you have seen any of their recent--it was last night or a couple of nights ago on the History Channel, they had, "Failure is not an Option." We, as a board, went to the museum, the Aerospace Museum, and saw the International Space Station movie. All those combined that brought home the reality of the significance of what we were trying to do and provide the tools, the recommendations, and certainly the ability that **NASA** can get back to fly and we can get human space flight back in orbit. You cannot do that without getting emotionally connected.

GEHMAN: Dr. Widnall?

WIDNALL: I think the board set a rather high target for itself. Certainly from my point of view, I wanted to make sure that we were not just the second report on a shelf to be joined by a third report relating to an accident caused by the same factors that we had become aware of during our study. So I think we tried to be more comprehensive.

GEHMAN: OK. Thank you very much.

QUESTION: Admiral, or whoever wants to join in on this one. The folks at **NASA** have been preparing themselves for a big shock over the last few months, and Administrator **O'Keefe** has gone so far as to say the report is going to be ugly.

QUESTION: You've put it on the table now. Is it ugly?

GEHMAN: I would not characterize it as ugly. Certainly, I would say, however, that the board was well aware that in the world in which **NASA** and all other big bureaucracies operate that if you really want to make them change something, sometimes you have to be rather dramatic with your reasons for making them change. And so, we tried to write a complete report. It's possible that we repeated ourselves a couple of times in there, but we did that for emphasis because we know how hard it is for big organizations to change.

Most all of us from this board have experience, either in the past or present, with running big organizations and we know how hard it is to get organizations to change. So we added some things in there for emphasis. We repeated some things for emphasis. And someone might construe that as ugly, but I don't construe it as ugly.

I view this report as clinical and technical and not unnecessarily ugly.

QUESTION: You said that the debate over how soon we replace the shuttle is a matter left to the nation and the Congress, but on the question of how long this shuttle can fly, sounds like you're saying quite awhile if you're talking about recertification by 2010 and then talking about the mid term maybe 15 years out or so. That sounds like well into the next decade if these changes are made.

GEHMAN: We didn't put a year on it, but we did make recommendations along the lines that you indicated, that if you intend to fly this thing beyond the short term, if you intend to fly it for 10 or 15 more years, there are a large number of things that need to be done in order to do that safely.

We didn't put a time certain on it. We did editorialize, however. It's not a recommendation, but it's in our comments section in chapter nine that we believe that another vehicle, either a complement or a replacement, is a very, very high priority.

As a matter of fact, we kind of criticize--we don't kind of--we criticize the United States for finding ourselves in a position where we are right now where we don't even have a vehicle on the drawing boards. And we are critical of that process. So we do have some sense of urgency that another human carrying vehicle needs to come along fairly quickly.

But no, we didn't put a time limit on how long we think the shuttle will last. We do believe that it can be operated in the mid term if we make the changes that we said.

(UNKNOWN): Let me add just one quick thought to that.

We say if the country intends to fly the shuttle past 2010, it needs to go through recertification. It's possible it will not pass the recertification.

GEHMAN: Or that it'll be too expensive.

GEHMAN (?): So I think we've come out kind of agnostic on how long it should fly depending on what happens when you take the close look at it.

WALLACE (?): And by the way, this is not the board not taking a position. That is our position. I mean, we spent hours on this exactly how we should characterize our position on how long the United States should use the shuttle.

And our position is that a), we are very disappointed that there's not a replacement vehicle at least on the drawing boards, and b), if you're going to fly it in the midterm you've got to change your management scheme, and if you're going to fly it beyond 2010, if you're going to fly it beyond 2010, you need to requalify it as a system or recertify it.

So this is not a non-position, this is a strong position, and might be a very expensive one.

QUESTION: My question has to do with the desired chain of command for safety. I guess I'm a little confused from reading the report exactly how this technical engineering authority would fit into the scheme.

Would this be like a separate entity with its own administrator, or would it be under the umbrella of **NASA** with some authority or chain of command that you could flesh out a little bit?

TURCOTTE: Let me give you an example.

GEHMAN: Let Richard Turcotte try a shot at this.

TURCOTTE: Let me give you an example from the aspect of the Navy and the Air Force, and the way we've run our programs. I'll give you an example of a squadron commander, or a commander of a ship, wants to make a modification or has a failing part that's in some way failing.

He does not have the decisional authority as that entity to do that. He has to go to an engineering authority commonly referred to as our system commands, separate authority that owns the technical requirements, submits a request, and if in fact the technical authority says it's good to go, then you can either fly that aircraft, or steam that ship, or that reactor, or that part, or dive that submarine, or jump out of that airplane, or whatever.

Unlike in **NASA**, the decisional authority for that waiver resided with the program. So our goal here is to have the program operate, maintain, fly the shuttle, but have the technical requirements reside separately so that the program has to go to another entity and is not deciding its own margins to operate.

GEHMAN: Mr. Wallace?

WALLACE: Well, just to clarify, I think one of your questions was not separate from **NASA**, not separate. Separate from the program that has the schedule that we got to get this built by this date.

Separate from the schedule, and I think the related recommendation also that follows that one is the independent safety program. Again, not separate from **NASA**, but the safety organizations that we found to be sometimes in sort of an undecipherable matrix, and we wanted a much more straight line authority on that.

QUESTION: The sixth chapter, I think, has a pretty strong indictment of the scheduling pressures that were put on the program. I think at one point you say that as a result, the reaction to the foam strikes focused, probably as a result focused less on safety than on keeping to schedule.

QUESTION: And the fact is that that, as you say, the schedule came right from the top from Sean **O'Keefe**. I mean, how big a factor was that? And how would you describe the relationship between the scheduling pressures and the decisions that were made about the foam?

GEHMAN (?): I think it's impossible to quantify it. Again, we tried to tell that story very thoroughly. I think you can see in there it's important to read the scheduling part of that chapter and then read what immediately follows it, which is the imaging request story. And it's in a logical sequence there because you see two things.

You see a concern about how this might affect the next mission, 114. And then I think you also see in there also a suggestion that well, there's nothing we can do about this on this flight. And so it gets to be a turnaround issue. And then there's the discussion about the flight readiness review criteria on the prior flight, 113.

So I think you read that entire story together, read the imaging story which follows it, and you can't put a number on this but you can get a sense for the schedule pressure.

QUESTION: We've talked a lot today, and you certainly discuss in your report a lot about **NASA's** culture. Several of you have stressed the point that when you deal with folks on the manufacturing fold (ph), when you deal with other personnel at **NASA** there is no lack of dedication, there is no lack of commitment to the program.

But it seems to me that culture is people. So at what level do you think **NASA** should attack this cultural problem? If it's not at the lowest level and we don't know if it's at the highest level, where should they be looking?



GEHMAN: Well, let me start off by trying to answer that and then I'll ask my board members to correct me if I get it wrong.

First of all, we in our report did not exactly equate culture to people as you did in your question. We equated culture as how people behave. And you can't change people's philosophies and attitudes, but you can change people's behaviors. And it's up to leadership at all levels to do that.

Now, I have some personal experience with this and many of our board members do too, in which a new boss comes in and he changes the way the organization operates or talks or thinks or its attitudes and things like that. And that's really what needs to happen is that they have to believe it in their gut and they have to say it every single day. And every time they deal with subordinates, every time there's any kind of a give-and-take going on or anything like that, they have to reinforce the kind of traits, attributes and characteristics that they want their organization to follow.

I mean, I'll give you a case in point. If you say that safety is the most important trait and characteristic in this organization, but then you require a person who's in charge of some program to come and travel to your office every month and report on how the schedule is coming, well, you're saying one thing and you're sending another message.

GEHMAN: So that's why we say that this is a difficult, challenging job. It's got to be done by the top level leadership, not just the administrator. He can't do it by himself, but at all levels of leadership, but we view it to be extraordinarily important.

Scott, did you want to jump in on this or--no?

OK, all right. Let us--all right, go ahead to the next question.

QUESTION: For Mr. Wallace, on the scheduling issue, the scheduling pressure came from the demands of the International Space Station program. The space station is still up there and occupied, and I think maybe even exerting some pressure today on the return to flight. How did your recommendations mitigate that pressure, particularly in the near term?

WALLACE: Well, I think we've made a strong story about the source of pressure, which you specifically identified, which was the node (ph) to complete and even--you might even argue that, gee, what's wrong with the screen saver? But you know, there's--I guess--a line between what's morale building and encouraging the work force and what actually then becomes another subtle form of pressure.

I think that the entire tragedy here is a massive stop and rethink point, a turning point for **NASA**, as it says in the board statement, which I think that the whole schedule gets kind of zero-based at this point.

GEHMAN: I think I'd like to add that the ISS does add schedule pressure, as it should. And oh, by the way, schedules are not bad, they're good managing tools. There's nothing wrong with using schedules as a good management tool. Everybody does it. I have been accused by this board of exerting schedule pressure on them.

(UNKNOWN): Yes, sir.

(LAUGHTER)

(UNKNOWN): 3:30 in the morning.

GEHMAN: But our concern is that various places in the organization are denying that there was any schedule pressure. And other places in the organization were screaming that there was schedule pressure. And it's that disconnect is what we're concerned about.

Of course there is schedule pressure with the ISS, because a crew has got to go up and a crew has got to go down, and supplies have got to go up and every once in a while the ISS has got to be boosted, et cetera, et cetera, et cetera. But we've found that the use of schedule pressure as a positive instrument was being misapplied and it was not turning into a positive reinforcement issue.

QUESTION: For Admiral Gehman, I wanted to ask you a question about your thermal protection system return-to-flight recommendations. When you issued your preliminary recommendations, it appeared to me that it called for before returning to flight, that you have a TPS inspection and repair capability. And as I look at the recommendations and the way that they're written now, it does not appear that it is a return to flight requirement.

And I wanted to sort of clarify that and ask you also how important is it to you that you do have a TPS repair capability in place before you fly again, given the fact that if you have an engine out on the way to the station or you undock, another crew could find itself in the same sort of predicament that Columbia was in?

GEHMAN: OK. I think it's just a misunderstanding. Recommendation 6.4.1 contains four provisions, all of which are return to flight.

QUESTION: So developing an RCC repair is a prerequisite...

GEHMAN: Is correct.

QUESTION: ... of return to flight.

GEHMAN: That is correct. Exactly as we issued it. It's just--we put RTF after the recommendation. We only put it once in there, and there are four provisions to it. But, yes, we are sticking by our interim recommendation that you must develop before return to flight an on-orbit inspection and repair for both the TPS and the RCC.

QUESTION: For the admiral or whoever would like to take it. You note in the report that managerial and organizational problems echo back to Challenger, that these same types of problems are still there and there are many parallels. And you also note that **NASA** has a history of not fixing that type of problem of getting back to business-as-usual after a short period of diligence after an accident. What do you think will happen if **NASA** neglects to or fails to fix their institutional problems as they exist today?

GEHMAN: Well, **NASA** is an independent agency responsible to the Congress and to the administration. There is no Cabinet officer overseeing **NASA**. Therefore, the enforcement mechanism must come from those two branches of government.

So we are putting a little bit of a burden here on both the Congress, the oversight committees and on the White House to put in some kind of a follow-on mechanism to make sure that these changes are implemented. And there's lots of ways to do it. You can establish review panels and blue ribbon panels and annual reports, and all that kind of good stuff, all of which we think should be done.

But I don't believe that we should just trust **NASA** to do this. I think there needs to be some follow up.

QUESTION: You talk about the cultural changes and the need for leadership to do that. Does that imply that there's a need for new leadership?

And what's the role--the Rogers commission talked a lot about astronaut leadership. There's also a question of engineering skills at the top leadership level. How much of a change needs to be put at the very top leadership of **NASA**, especially when you say they're not the ones--they say they didn't see any schedule pressures.

GEHMAN: We don't have any opinion, one way or another, about the individuals at the top leadership of **NASA**. We've gotten nothing but cooperation from **NASA**. We've heard all the right words from **NASA** leadership.

But we, as a board, set a long time ago an internal rule that we were not going to try and chase the rabbit here. That is, as **NASA** changes and as they do things,

we aren't going to be continuously trying to comment on the things that they've said or done or implemented.

So as we like to say, "T equals zero." T equals zero is 1 February for us, as we are reporting on this event as of the date and time of the crash.

So I have no reason to believe that there is anything in this report that cannot be implemented by the leadership of **NASA** if they choose to do so. So I think it's more of a philosophical thing than a competency thing.

QUESTION: And that segues, Admiral--segues right into the question that I had, and I'd like for you and maybe Mr. Wallace to answer this.

And that is, yes, they can do these things if they do do. You guys believe in your heart of hearts that **NASA** will, in fact, be able to effect these kind of changes, because several places in the report you point out: We have no confidence. That other corrective actions will improve this. And changes we recommend will be difficult to accomplish, and they will be internally resisted by **NASA**.

So I'm wanting a personal opinion from both of you, will they do these things?

GEHMAN: We'll let Mr. Wallace go first.

(LAUGHTER)

WALLACE: My confidence is fairly high. I don't see that we draw--I mentally sort of can't draw a sharp line between some of the organizational changes and some of the cultural changes.

WALLACE: I think they go hand in hand. So if you, you know--an empowered independent organization that owns the technical qualifications and requirements and the waiver authority, coupled with a really empowered safety organization, and we're talking about organizations which all have a final signature on the certificate of flight readiness, I think those--the evolution of that organization which then sort of takes the authority away, to some extent, from the program that's really got--trying to meet the schedule and build the thing.

So I also think that the fact that this is the second loss and we've evaluated the accident in the historical context, including a very point-by-point comparison of the Challenger, a lesson we learned here is we got a--it didn't get fixed last time, there has to be a different approach now and I really think there will be.

GEHMAN: I think it's fair even though we didn't write this down in our report to say that we find two problems in this area. The first problem is that **NASA** has--**NASA** management over the years--and over the years, due to external influences, as well as internal influences--has morphed its management structure

to where so much authority and power or so much responsibility has been put into one vertical chain--the program manager--and that they've lost all their checks and balances and independent research and independent engineering and the likely stuff. That's one problem.

The second problem is **NASA's** been told this 10 times, so they're guilty of two things. And we put that in there for emphasis, to get out an order to satisfy ourselves, that we have enough emphasis in here to satisfy ourselves that they will change, and that the system will make them change and that they will buy into it. So, yes, we've added some of those things for emphasis, as I said in my opening remarks.

QUESTION: Admiral Gehman, would you talk a little bit about the rescue scenario? Do you believe that with normal and reasonable procedures that the MMT should have arrived at that EVA on Flight Day 5?

GEHMAN: I would separate in my mind your question. Whether or not an EVA to inspect the wing was prudent or not from the rescue thing, I consider that to be two different things. From my understanding, to go out and take a walk and lean over the wing to see if you had a hole in the RCC is not very risky. It's well within the capability of the training of the astronauts.

If they were really curious and really had a lot of engineering curiosity, they were really suspicious and they were really concerned about pinning down everything that might be wrong with the orbiter, they would have attempted, first of all, to get some imagery. And if the imagery was inconclusive--which it may have been, by the way, you know, they may have gotten the imagery in and it proved nothing--I consider that going out and taking a look at the wing to be relatively a prudent thing to do.

The rescue thing--and you used the word rescue in your question--that's a whole 'nother enterprise and the risk goes way up when you do that and I wouldn't want to comment on whether or not it was something that they would have really, no kidding, chosen to do.

GEHMAN: The only thing we do know, and everybody has agreed upon this, the Congress, the president, the administrator of **NASA**, is that if we had gone out there and if we had seen a hole in the wing and we knew that it was life-threatening, we would have done something.

We wouldn't have sat here and done nothing and wish them, you know, wish them bon voyage. So I consider those two parts of your question to be two separate, two completely separate things.

MODERATOR: OK, thank you for coming. That's going to be the last question, and we are not doing the table rush we normally do, so forget about that, and

we're going to do some one-on-one interviews with some of the board members in two rooms that are set up in the other room.

I've got a schedule for the admiral, and we'll have some interviews with the other board members as well.

Thanks.

GEHMAN: Thank you very much.

- end -